

THE MARS SURVEYOR PROGRAM, HUMAN EXPLORATION OBJECTIVES AND THE CASE FOR GUSEV CRATER. Nathalie A. Cabrol, Edmond. A. Grin, and Kevin Hand. NASA Ames Research Center, Space Science Division, MS 245-3, Moffett Field, CA 94035-1000. Email:ncabrol@mail.arc.nasa.

Rationale: It has been demonstrated during the past years that by its configuration, extended history of water ponding and sedimentary deposition, Gusev crater is one of the most favorable sites to consider for the incoming exploration of Mars. It provides exceptional possibilities to document the evolution of water, climate changes, and possibly the evolution of life on Mars through time. Because of all these reasons, it is probably one of the most interesting sites to target for sample return missions and human exploration, but as well, it is by all mean an excellent target for the Surveyor '01, in spite of the current imposed mission constraints, as we propose to demonstrate.

Sciences Objectives: Because they have been developed in many previous publications (see especially Cabrol et al., 1998 *Mars Surveyor 2001 Landing Site Workshop*), we will not present all the science arguments again but summarize them in the following tables 1 and 2, and show how Gusev will allow to address the Surveyor Program objectives. We will then develop the rationale to show that there are strong supportive arguments to consider Gusev for '01.

Two candidate-sites in Gusev present comparably high-interest for science return. They are: (a) the Thyra crater (14.5°S/186°W) and the delta of Ma'adim Vallis in Gusev (15°S/184.6°W).

Table 1: Surveyor Program Objectives

Objective	Type of Site
Diverse Geologic Record	Paleolake bed Outflow Runoff outlets
Climate History	Aqueous sediment Lacustrine sediment Deep hydrothermal system
Chemical Evolution	Thermal Springs (possible in Gusev) Lacustrine sediments Aqueous environments
Fossil Life	Thermal Springs Lake beds
Extant Life	Current hydrothermal Sites Frozen in ice Caves Evaporite deposits Endoliths
Resources	Liquid Water/ice

Table 2 Merit and Expected Science Return in Gusev

Science	Merit	Observed Environment
Diversified Geology	high	Crustal mat. Volc/hydroth. mat. Fluvio-lacustrine mat. aeolian mat.
Climate History	high	Fluvio-lacustrine dep. Lacustrine varves
Exobiology	high	2 Gyr of fluvio-lacustrine history Aqueous environment Possible frost mounds (near Thyra only) Possible hydrothermal activity in Thyra
Sampling Diversity	high	Sedimentary rocks Igneous rocks Soil Extinct/extant life (?)
Resources	high	Frost mounds (near Thyra) <i>need to be documented by MGS</i>

Exobiology and Resources: The existence of possible frost mounds in Gusev has been proposed (Cabrol et al., 1997, 1999). The hypothesis of ice mounds has been tested against volcanism, aeolian and water erosion action on sedimentary deposits. and find support both in the physiography and morphology of the mounds and their lacustrine paleoenvironment (Cabrol et al., 1999). The presence of preserved frost mounds would have critical implications, for it raises the possibility of the existence of current protected subsurface reservoirs of fossil ice, which volume can be significant as shown by the example of Gusev mound No.9 - 420,300 m³ (Cabrol et al., 1999). The state of preservation of the mounds (shown by only few scar features among the well-preserved structures) indicates that the cores of ice (if ice hypothesis confirmed by new MGS data) are most likely still present under the overburden. We foresee two major implications that are valid not only for Gusev mounds but for Martian pingos and/or masses of segregated ice in general: (1) frost mounds with several meters of overburden that are likely cemented by salts provide an effective protection against the deadly UV bombardment that reaches the surface of Mars, and they provide water; therefore, they could be seen as potential oases for life; (2) large masses of segregated ice are unique potential resources that could be used both by automated robotics and manned missions to generate sources of energy, such as rocket combustible and water. Frost mounds are highly favorable candidates for scout drill missions. According to our current knowledge, the only other (abundant ?) source of liquid water on Mars